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JP

9-270584

(54) [Title of the Invention] MULTILAYER PRINTED CIRCUIT BOARD

(570 [Abstract]

[Object] The object of the present invention relating to a multilayer printed circuit board in which a fine printed circuit is formed on the surface of an insulating substrate consisting of a composite material containing an organic resin and an inorganic filler, is to obtain a printed circuit board in which the insulating substrate is colored without the degradation of characteristics.

[Means to Attain the Object] A multilayer printed circuit board 1 comprising an insulating substrate 2 consisting of a composite material containing an organic resin and an inorganic filler, and a printed circuit 3 consisting of a metal with a low electric resistance, wherein the insulating substrate 1 (sic) contains at least one coloring agent selected from a group including carbon, silicon carbide, boron carbide, titanium carbide, silicon nitride, boron nitride, titanium nitride, and titanium boride in a content ratio of 0.01 to 5 wt.%. In particular, when the coloring agent is at least one compound selected from a group including carbon, titanium nitride, silicon carbide, and titanium carbide, the coloring agents are individually dispersed in the insulating substrate in the form of particles or particle aggregates with a maximum size of no more than 10  $\mu\text{m}$ .

[Patent Claims]

[Claim 1] A multilayer printed circuit board comprising an insulating substrate consisting of a composite material containing an organic resin and an inorganic filler, and a printed circuit consisting of a metal with a low electric resistance, wherein said insulating substrate contains at least one coloring agent selected from a group including carbon, silicon carbide, boron carbide, titanium carbide, silicon nitride, boron nitride, titanium nitride, and titanium boride in a content ratio of 0.01 to 5 wt.%.

[Claim 2] The multilayer printed circuit board as described in Claim 1, wherein when said coloring agent is at least one compound selected from a group including carbon, titanium nitride, silicon carbide, and titanium carbide, the coloring agents are individually dispersed in the insulating substrate in the form of particles or particle aggregates with a maximum size of no more than 10  $\mu\text{m}$ .

Multilayered wiring board used in package for semiconductor device accommodation e.g. IC - has insulated substrate made of organic resin, inorganic filler and colouring agent with specific weight proportion

Patent Assignee: KYOCERA CORP (KYOC )

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The wiring board (1) has an insulated substrate (2) which contains organic resin and inorganic filler. A colouring agent selected from silicon carbide, boron carbide, titanium carbide, silicon nitride, boron nitride, titanium nitride and titanium boride with 0.01-5wt% is also contained in the substrate.

A wiring circuit (3) which contains flow resistance metal is formed on the insulated substrate.

ADVANTAGE - Improves bonding nature and mounting nature of semiconductor device. Prevents reduction in yield by poor external appearance such as blotches and irregular colouring. Improves device characteristics.

Dwg.1/1

Title Terms: MULTILAYER; WIRE; BOARD; PACKAGE; SEMICONDUCTOR; DEVICE; ACCOMMODATE; IC; INSULATE; SUBSTRATE; MADE; ORGANIC; RESIN; INORGANIC; FILL; COLOUR; AGENT; SPECIFIC; WEIGHT; PROPORTION

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## (57) 【要約】

【課題】無機質フィラーと有機樹脂からなる絶縁基板の表面に微細な配線回路が形成された多層配線基板において、絶縁基板を特性上の支障なしに着色された配線基板を得る。

【解決手段】有機樹脂と無機フィラーとの複合材料からなる絶縁基板 2 と、低抵抗金属からなる配線回路 3 を具備した多層配線基板 1 において、絶縁基板 1 が、炭素、炭化珪素、炭化硼素、炭化チタン、窒化珪素、窒化硼素、窒化チタンおよび硼化チタンの群から選ばれる少なくとも 1 種の着色剤を 0.01 ~ 5 重量% の割合で含有し、特に着色剤が、炭素、窒化チタン、炭化珪素、炭化チタンの群から選ばれる少なくとも 1 種の場合、着色剤は、最大粒径が 10 μm 以下の粒子あるいは凝集粒子として、絶縁基板中に独立して分散させる。

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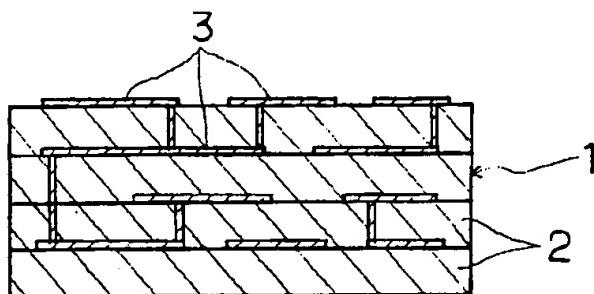
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## (57) [Abstract]

[Problem] insulating substrate metallized substrate which colors to hindrance none on characteristic is obtained in multilayer metallized substrate where microscopic metallization circuit was formed to surface of insulating substrate which consists of inorganic filler and organic resin.

[Means of Solution] Consists of composite material of organic resin and inorganic filler insulating substrate 2 which, In multilayer metallized substrate 1 which possesses with metallization circuit 3 which consists of the low resistance metal putting, insulating substrate 1, It contains colorant of at least 1 kind which is chosen from group of the carbon, silicon carbide, carbonizing boron, titanium carbide, silicon nitride, boron nitride, the titanium nitride and titanium boride at ratio of 0.01 to 5 weight%, when especially colorant, it is at least 1 kind, which is chosen from group of carbon, titanium nitride, the silicon carbide and titanium carbide, maximum particle diameter becoming independent in insulating substrate as particle or aggregated particle of 10 μm or less, it disperses

colorant.



#### 【特許請求の範囲】

【請求項 1】 有機樹脂と無機フィラーとの複合材料からなる絶縁基板と、低抵抗金属からなる配線回路とを具備した多層配線基板において、前記絶縁基板が、炭素、炭化珪素、炭化硼素、炭化チタン、窒化珪素、窒化硼素、窒化チタンおよび硼化チタンの群から選ばれる少なくとも 1 種の着色剤を 0.01 ~ 5 重量% の割合で含有することを特徴とする多層配線基板。

【請求項 2】 前記着色剤が、炭素、窒化チタン、炭化珪素、炭化チタンの群から選ばれる少なくとも 1 種の場合、該着色剤は、最大粒径が  $10 \mu\text{m}$  以下の粒子あるいは凝集粒子として、絶縁基板中にそれぞれ独立して分散していることを特徴とする請求項 1 記載の多層配線基板。

#### [Claim(s)]

[Claim 1] In multilayer metallized substrate which possesses with insulating substrate which consists of the composite material of organic resin and inorganic filler and metallization circuit which consists of the low resistance metal, aforementioned insulating substrate, multilayer metallized substrate which designates that the dye of at least 1 kind which is chosen from group of carbon, the silicon carbide, carbonizing boron, titanium carbide, silicon nitride, boron nitride, titanium nitride and the titanium boride is contained at ratio of 0.01 to 5 weight % as feature.

[Claim 2] When aforementioned colorant, it is at least 1 kind which is chosen from the group of carbon, titanium nitride, silicon carbide and titanium carbide, as for the said colorant, maximum particle diameter becoming independent respectively in insulating substrate as the particle or aggregated particle of  $10 \mu\text{m}$  or less, multilayer metallized substrate which it states in the Claim 1 which designates that it is dispersed as feature.

#### 【発明の詳細な説明】

##### 【0001】

【発明の属する技術分野】 本発明は、例えば、半導体素子収納用パッケージなどに適した、無機フィラーと有機樹脂の複合材料からなる着色の絶縁基板を具備した多層配線基板に関するものである。

##### 【0002】

【従来技術】 従来より、多層配線基板、例えば、半導体素子を収納するパッケージに使用される多層配線基板として、高密度の配線が可能なセラミック多層配線基板が多用されている。この多層セラミック配線基板は、アルミナなどの絶縁基板と、その表面に形成されたWやMo等の高融点金属からなる配線導体とから構成されるもので、この絶縁基板の一部に凹部が形成され、この凹部内に半導体素子が収納され、蓋体

#### [Description of the Invention]

##### [0001]

[Technological Field of Invention] It is something regarding multilayer metallized substrate which possesses insulating substrate of the coloration where this invention was suited for for example semiconductor element package, etc consists of the composite material of inorganic filler and organic resin.

##### [0002]

[Prior Art] From until recently, ceramic multilayer metallized substrate where metallization of high density is possible as multilayer metallized substrate which is used for package which stores up the multilayer metallized substrate and for example semiconductor element, is used. As for this multilayer ceramic metallized substrate, alumina or other insulating substrate, metallization conductor which consists of W and Mo or other

によって凹部を気密に封止されるものである。

【0003】ところが、このようなセラミック多層配線基板の絶縁基板を構成するセラミックスは、硬くて脆い性質を有することから、製造工程または搬送工程において、セラミックスの欠けや割れ等が発生しやすく、半導体素子の気密封止性が損なわれることがあるために歩留りが低い等の問題があった。

【0004】また、多層セラミック配線基板においては、焼結前のグリーンシートにメタライズインクを印刷して、印刷後のシートを積層して焼結させて製造されるが、その製造工程において、高温での焼成により焼成収縮が生じるために、得られる基板に反り等の変形や寸法のばらつき等が発生しやすいという問題があり、回路基板の超高密度化やフリップチップ等のような基板の平坦度の厳しい要求に対して、十分に対応できないという問題があった。

【0005】そこで、最近では、プリント基板では銅箔を接着した基板表面にエッチング法により微細な回路を形成し、しかるのちにこの基板を積層して多層化した基板も提案されている。また、このようなプリント基板においては、その強度を高めるために、有機樹脂に対して、球状あるいは纖維状の無機質フィラーを分散させた基板も提案されており、これらの複合材料からなる絶縁基板上に多数の半導体素子を搭載したマルチチップモジュール（MCM）等への適用も検討されている。

## 【0006】

【発明が解決しようとする課題】一方、多層配線基板や半導体素子収納用パッケージなどに使用される配線基板の絶縁基板に要求される性質としては、絶縁性などの電磁気的特性、強度等の機械的性質、耐熱性等の熱的性質、耐食性等の化学的性質の他に、外観が黒色であることが望まれている。これは黒色の場合には僅かな塵埃でも発見が容易であり、また、黒色の場合には部品が摩耗したり、破損した場合、その部位をはっきりと識別することができる利点を有する。

【0007】また、近年では、電子部品や半導体素子の実装や検査工程の自動化が進み配線部と絶縁基板との識別を光学的に行なうことが多く、絶縁基板と配線回路とのコントラスト

high melting point metal which were formed to surface, being something which is constituted. recessed part is formed by portion of this insulating substrate, semiconductor element is stored up inside this recessed part, recessed part it is something which is sealed to the airtight with lid.

[0003] However, as for ceramic which forms insulating substrate of this kind of ceramic multilayer metallized substrate, being hard, notch and crack etc of ceramic are easy to occur from fact that it possesses property which is brittle, in the production step or transport step, there was a or other problem where yield rate is low because there are times when airtight seal characteristic of semiconductor element is impaired.

[0004] In addition, Regarding multilayer ceramic metallized substrate, Printing metallizing ink in greensheet before sintering, Laminating sheet after printing, sintering it is produced, but, In production step, there was a problem that with high temperature there to be a problem that, because bake shrinkage occurs due to calcining, warp or other deformation and scatter etc of dimension are easy to occur in the substrate which is acquired, it cannot correspond to fully vis-a-vis the ultrahigh density conversion of circuit board and request where flatness of the flip chip or other substrate is harsh.

[0005] Then, recently, with print substrate it forms microscopic circuit in substrate surface which glues copper foil with etching method, does after driving laminating this substrate, also substrate which multilayering is done is proposed. In addition, in order to raise strength regarding this kind of print substrate, also substrate which disperses spherical shape or fibrous inorganic filler vis-a-vis the organic resin, is proposed. also application to multichip module (MCM) etc which installs the multiple semiconductor element on insulating substrate which consists of these composite material is examined.

## 【0006】

【Problems to be Solved by the Invention】On one hand, it is desired to other than insulating property or other electromagnetic characteristic, strength or other mechanical property, the heat resistance or other thermal property and corrosion resistance or other chemical property, as property which is required to insulating substrate of the metallized substrate which is used for multilayer metallized substrate and semiconductor element package etc, that the external appearance is black. When as for this in case of black discovery is easy even with the little dirt, in addition, is black, when part wears, the breakage does, it possesses benefit which can identify site clearly.

[0007] In addition, recently, mount of electronic part and semiconductor element and automation of inspection process advance, are many times when it identifies with metallization

をつけて接続箇所の視認性が高める必要がある。さらに、黒色は重厚感があり、審美性に優れる点からも好まれている。

【0008】しかしながら、多層配線基板に用いられる無機質フィラーと有機樹脂からなる絶縁基板の着色化については、これまで注目されておらず、着色剤による特性の変化についても検討されていないのが現状であった。

【0009】従って、本発明は、無機質フィラーと有機樹脂からなる絶縁基板の表面に微細な配線回路が形成された多層配線基板において、絶縁基板を特性上の支障なしに着色された配線基板を提供することを目的とする。

#### 【0010】

【課題を解決するための手段】本発明者らは、上記のような課題について鋭意検討した結果、無機フィラーと樹脂とを均一に混合した複合材料よりなる絶縁基板に対して、着色剤として、炭素、炭化珪素、炭化硼素、炭化チタン、窒化珪素、窒化硼素、窒化チタンおよび硼化チタンの群から選ばれる少なくとも1種が好適に使用されること、しかもこれらの着色剤を0.01～5重量%の割合で配合すること、とりわけ、前記着色剤は、最大粒径が10μm以下の粒子あるいは凝集粒子として、絶縁基板中にそれぞれ独立して分散されることにより、表面に形成された微細な配線に影響を及ぼすことなく、黒色を呈する基板を得ることができ、今後の回路の超微細化、精密化の要求に応えさらに黒色をベースとする良好な色調を有する超精密微細配線多層回路基板が得られることを見出した。

#### 【0011】

【発明の実施の形態】本発明の多層配線基板の概略図を図1に示した。本発明の多層配線基板1は、複数の絶縁基板2と、配線回路3をと具备し、配線回路3は、絶縁基板2間、または絶縁基板2の表面に形成されている。また、配線回路3は、例えば、銅、アルミニウム、金、銀などの低抵抗金属により構成される。

#### 【0012】

本発明によれば、上記絶縁基板は、無機質フィ

part and insulating substrate in optical, attaching contrast of insulating substrate and the metallization circuit, it is necessary for visual recognition of connecting site to raise. Furthermore, black is a weight feel, is liked even from point which is superior in aesthetics.

[0008] But, fact that we are not observed so far concerning coloring of the insulating substrate which consists of inorganic filler and organic resin which are used for the multilayer metallized substrate, concerning change of characteristic with dye we are not examined was present state.

[0009] Therefore, as for this invention, insulating substrate it designates that metallized substrate which colors to hindrance none on characteristic is offered as objective in the multilayer metallized substrate where microscopic metallization circuit was formed to surface of insulating substrate which consists of inorganic filler and organic resin.

#### [0010]

[Means to Solve the Problems] As for these inventors, As description above concerning problem result of diligent investigation, In insulating substrate which consists of composite material which mixes with inorganic filler and resin to uniform confronting, colorant doing, carbon, silicon carbide, carbonizing boron, titanium carbide, silicon nitride, boron nitride, at least 1 kind which is chosen from group of titanium nitride and titanium boride is used for ideal, Furthermore these colorant are combined at ratio of 0.01 to 5 weight %, Especially, As for aforementioned colorant, maximum particle diameter particle or aggregated particle of 10 μm or less doing, Becoming independent respectively in insulating substrate, be able to acquire the substrate which displays black without exerting influence on microscopic metallization which was formed to surface by dispersing, you answered to therequest of ultrafine conversion and precision conversion of future circuit, furthermore you discovered fact that ultraprecision fine metallization multilayer circuit board which possesses good color which designates black as base is acquired.

#### [0011]

[Embodiment of Invention] Conceptual diagram of multilayer metallized substrate of this invention was shown in Figure 1. multilayer metallized substrate 1 of this invention, possesses with insulating substrate 2 and metallization circuit 3 of the multiple, metallization circuit 3, is formed between insulating substrate 2, or surface of the insulating substrate 2. In addition, metallization circuit 3 is formed by for example copper, aluminum, gold and silver or other low resistance metal.

[0012] According to this invention, above-mentioned insulating

ラードと有機樹脂との複合材料からなり、無機質フィラーは、有機樹脂中に50～80体積%の割合で均一に分散されている。

【0013】この複合材料を構成する無機質フィラーとしては、 $\text{SiO}_2$ 、 $\text{Al}_2\text{O}_3$ 、 $\text{ZrO}_2$ 、 $\text{TiO}_2$ 、 $\text{AlN}$ 、 $\text{BaTiO}_3$ 、 $\text{SrTiO}_3$ 、ゼオライト、 $\text{CaTiO}_3$ 、ほう酸アルミニウム等の公知の材料が使用できる。フィラーの形状は平均粒径が20  $\mu\text{m}$ 以下、特に10  $\mu\text{m}$ 以下、最適には7  $\mu\text{m}$ 以下の略球形形状の粉末の他、平均アスペクト比が2以上、特に5以上の繊維状のものや、織布物も使用できる。

【0014】一方、無機質フィラーが分散される有機樹脂としては、PPE(ポリフェニレンエーテル)、BTレジン(ビスマレイミドトリアジン)、エポキシ樹脂、ポリイミド樹脂、フッ素樹脂、フェノール樹脂等の樹脂からなり、とりわけ原料として室温で液体の熱硬化性樹脂であることが望ましい。

【0015】本発明によれば、絶縁基板2を構成する複合材料において、着色剤として、炭素、炭化珪素、炭化硼素、炭化チタン、窒化珪素、窒化硼素、窒化チタンおよび硼化チタンの群から選ばれる少なくとも1種を着色剤として配合するものである。特に、これらの中でも炭素、炭化珪素、炭化チタン、窒化チタンから選ばれる少なくとも1種がよい。この着色剤は、0.01～5重量%、特に0.05～4重量%、さらには0.1～3重量%の割合で添加するのがよい。これは、添加量が0.01重量%より少ないと着色効果が十分でなく、基板において色ムラ等が発生し、また、添加量が5重量%より多いと絶縁基板自体の電気抵抗が低下したり、誘電率や誘電正接等の電気特性がばらつく原因となるためである。

【0016】また、この着色剤は、粒子または凝集粒子として存在するが、上記着色剤のうち、炭素、窒化チタン、炭化珪素、炭化チタンのようにそれ自身の低抵抗の着色剤を用いる場合には、これら着色剤粒子は最大粒径が10  $\mu\text{m}$ 以下、特に8  $\mu\text{m}$ 以下の粒子として、個々に独立して存在することが望ましい。これは、上記低抵抗の着色剤では、絶縁基板の表面に形成された微細な配線回路の間に大きな粒子として、または微細な粒子が連なった形で存在すると、配線回路間の抵抗が低下したり、場合によってはショートするなど、配線回路の信頼性を損ねる場合があるためである。

substrate consists of the composite material of inorganic filler and organic resin, inorganic filler in organic resin is dispersed to uniform at ratio of 50 to 80 vol%.

[0013] You can use material of  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{ZrO}_2$ ,  $\text{TiO}_2$ , the  $\text{AlN}$ ,  $\text{BaTiO}_3$ ,  $\text{SrTiO}_3$ , zeolite,  $\text{CaTiO}_3$  and aluminum borate or other public knowledge as the inorganic filler which forms this composite material. As for shape of filler average particle diameter 20  $\mu\text{m}$  or less and especially 10  $\mu\text{m}$  or less, in optimum other than powder of spherical of 7  $\mu\text{m}$  or less, average aspect ratio fibrous things such as 2 or more and especially 5 or greater. You can use also woven fabric ones.

[0014] On one hand, it consists of PPE (polyphenylene ether), BT resin (bismaleimide triazine), epoxy resin, the polyimide resin, fluororesin and phenolic resin or other resin as organic resin where inorganic filler is dispersed, it is desirable to be a thermosetting resin of liquid with room temperature as starting material especially.

[0015] It is something which combines at least 1 kind which is chosen from the group of carbon, silicon carbide, carbonizing boron, titanium carbide, silicon nitride, the boron nitride, titanium nitride and titanium boride according to this invention, in composite material which forms insulating substrate 2, as colorant, as colorant. Especially, at least 1 kind which even among these is chosen from carbon, the silicon carbide, titanium carbide and titanium nitride is good. As for this colorant, 0.01 to 5 weight% and especially 0.05 to 4 wt% or more, furthermore it is good to add at ratio of 0.1 to 3 wt%. As for this, when addition quantity is less than 0.01 wt%, coloring effect the color unevenness etc occurs not to be a fully, in substrate, in addition when the addition quantity is more than 5 weight%, electrical resistance of insulating substrate itself decreases, is because it becomes cause where dielectric constant and dielectric loss tangent or other electrical property disperse.

[0016] In addition, this colorant exists as particle or aggregated particle, but among the above-mentioned colorant, like carbon, titanium nitride, silicon carbide and the titanium carbide when colorant of low resistance of that itself is used, as for these colorant particle maximum particle diameter becoming independent individually as particle of 10  $\mu\text{m}$  or less and especially 8  $\mu\text{m}$  or less, it is desirable to exist. As for this, with colorant of above-mentioned low resistance, when between the microscopic metallization circuit which was formed to surface of insulating substrate or it exists in the form where microscopic particle is connected as big particle, resistance between metallization circuit decreases, short such as does, are times when the reliability of metallization circuit is impaired depending upon in case.

【0017】このような多層配線基板は、例えば、次のようにして作製される。まず、絶縁基板を作製するに、無機質フィラー粉末と、粉末または液状の有機樹脂に加え、前述した着色剤を所定の割合で混練機（ニーダ）や3本ロールなどの混練機等の手段によって十分に混合する。この時、前述したように、着色剤は、絶縁基板中に均一に粉末または凝集粒子として独立して分散させることが望ましい。そのためには、無機質フィラーと有機樹脂との混練に要する時間よりさらに延長して混練を長時間行うことにより均一分散化が可能である。

【0018】次に、十分に混合されたものを圧延法、押し出し法、ドクターブレード法などの周知の樹脂成形方法により、シート状に成形して絶縁基板を得る。この時、有機樹脂を半硬化させておくのが望ましく、半硬化には、有機樹脂は熱可塑性樹脂の場合には、加熱下で混合したものを冷却し、熱硬化性樹脂の場合には、完全固化するに十分な温度よりもやや低い温度に加熱すればよい。

【0019】そして、この絶縁基板の表面に配線回路を形成する。配線回路の形成には、銅等の金属箔を絶縁層に接着剤で張りつけた後に、回路パターンのレジストを形成して酸等によって不要な部分の金属をエッチング除去するか、予め打ち抜きした金属箔を張りつける。他の方法としては、絶縁層の表面に銅、アルミニウム、金、銀などの金属粉末を含む導体ペーストを回路パターンにスクリーン印刷や、フォトレジスト法等によって形成した後、乾燥して加圧し、絶縁層に密着させることで形成できる。

【0020】次に、配線回路を形成した絶縁基板に対して、所望により打ち抜き法やレーザー加工によりビアホールを形成して上記の導体ペーストを充填する。そして、複数の絶縁基板を位置合わせて絶縁層を積層し加熱しながら圧着して、絶縁層の有機樹脂を完全に硬化させることにより、多層配線基板を得ることができる。

【0021】このようにして得られる多層配線基板は、絶縁基板が黒色系に着色されているために、その表面に形成された銅、アルミニウムなどの低抵抗金属からなる配線回路とのコントラストが明確であるために、光学的手段による電子部品の実装やICの実装、ボンディングなどに好適であり、しかも、シミや色むらなどの外観不良による歩留りの低下を低減することもできる。

【0022】

[0017] This kind of multilayer metallized substrate is produced for example following way. First, insulating substrate is produced, mixes colorant which is mentioned earlier inorganic filler powder and in addition to powder or liquid organic resin, to fully at specified ratio with kneader (kneader) and 3-roll mill or other kneader or other means. As this time, mentioned earlier, as for colorant, in insulating substrate becoming independent in uniform as powder or aggregated particle, it is desirable to disperse. For that, furthermore extending from time when it requires in the kneading of inorganic filler and organic resin, uniform dispersion conversion is possible by the lengthy doing kneading.

[0018] Next, forming in sheet those which are mixed to fully with the rolling method, extrusion method and doctor blade method or other widely known resin molding method, you obtain the insulating substrate. This time, semicured it is desirable, in semicured, as for organic resin to do organic resin, in case of thermoplastic resin, under heating those which are mixed cools in case of thermosetting resin, if complete solidification does to the temperature which is a little lower than sufficient temperature should have heated.

[0019] And, wiring circuit is formed in surface of this insulating substrate. copper or other metal foil after sticking to insulating layer with adhesive, forming the resist of circuit pattern, etching it removes metal of unnecessary portion information of wiring circuit with acid, or etc it sticks metal foil which notch is done beforehand. As other method, after forming with screen printing and photoresist method etc, drying in circuit pattern, it can pressurize conductive paste which includes the copper, aluminum, gold and silver or other metal powder in surface of insulating layer, it can form by fact that it sticks to insulating layer.

[0020] Next, forming via vis-a-vis insulating substrate which formed metallization circuit, with desire with punching method, and laser machining above-mentioned conductive paste it is filled. And, positioning doing insulating substrate of multiple, while laminating the insulating layer and heating pressure bonding doing, it can acquire multilayer metallized substrate by hardening organic resin of insulating layer completely.

[0021] Is acquired in this way as for multilayer metallized substrate which, Because contrast of metallization circuit which consists of copper and the aluminum or other low resistance metal which were formed to surface because insulating substrate is colored to the black, is clear, it is ideal in mount of electronic part with optical means and mount and bonding etc IC, furthermore, it is possible also to decrease decrease of yield rate with stain and color unevenness or other poor external appearance.

[0022]

【実施例】本発明の多層配線基板を製造するために、無機フィラーとして平均粒径が $5\text{ }\mu\text{m}$ の溶融シリカ50体積%と、BTレジン50体積%を秤量し、さらに着色剤として、炭素(C)、炭化珪素(SiC)、炭化硼素(B<sub>4</sub>C)、炭化チタン(TiC)、窒化珪素(Si<sub>3</sub>N<sub>4</sub>)、窒化硼素(BN)、窒化チタン(TiN)、硼化チタン(TiB<sub>2</sub>)を全量中の割合が表1に示す比率になるように添加した。なお、表1中試料No.31は、溶融SiO<sub>2</sub>:エポキシ樹脂=50:50体積%。試料No.32は、SrTiO<sub>3</sub>:BTレジン=50:50の体積比率で混合したものに着色剤を添加した。

[Working Example(s)] In order to produce multilayer metallized substrate of this invention, average particle diameter measured weight did the fused silica 50 vol% and BT resin 50 vol% of 5  $\mu\text{m}$  as inorganic filler, in order carbon (C), the silicon carbide (SiC), carbonizing boron (B<sub>4</sub>C), titanium carbide (TiC), silicon nitride (Si<sub>3</sub>N<sub>4</sub>), boron nitride (BN), titanium nitride (TiN) and the titanium boride (TiB<sub>2</sub>) to become ratio which ratio in total amount shows in the Table 1 furthermore as colorant, added. Furthermore, as for sample No.31 in Table 1, molten Si O<sub>2</sub> : epoxy resin = 50:50 vol%. sample No.32 added colorant to those which are mixed with volume ratio of the SrTiO<sub>3</sub> : BT resin = 50:50.

【0023】これに溶媒としてBTレジンに対して酢酸ブチル、エポキシ樹脂に対してはメチルエチルケトンを加え、さらに樹脂の硬化を促進させるための触媒を添加し、攪拌翼が公転および自転する攪拌機により1~3時間混合した後、スラリーを調製した。

[0023] Furthermore catalyst in order to promote hardening resin was added including methyl ethyl ketone vis-a-vis butyl acetate and epoxy resin vis-a-vis the BT resin as solvent in this, 1 to 3 hours after mixing, slurry was manufactured with mixer where impeller blade revolves and rotates and.

【0024】このスラリーをドクターブレード法により、厚み200 $\mu\text{m}$ のシート状に成形した。このシートを50mm□にカットし、パンチング法によりビアホールを形成した。このシートに銅を主成分とする導体ペーストをスクリーン印刷法により線幅50 $\mu\text{m}$ 、回路間距離50 $\mu\text{m}$ の回路を形成し、ビアホールにも導体インクを埋め込んだ。このようにして得られたシートを8層積層し、200°C、30分、大気中で樹脂を硬化し、多層基板を得た。

[0024] This slurry with doctor blade method, it formed in sheet of thickness 200  $\mu\text{m}$ . This sheet was cut off in 50 mm square, via was formed with the punching method. circuit of linewidth 50  $\mu\text{m}$  and circuit interval 50  $\mu\text{m}$  was formed conductive paste which designates copper as main component in this sheet with screen printing method, the conductor ink was imbedded to also via. sheet which it acquires in this way was laminated 8 layer, the resin was hardened in 200 °C, 30 min and atmosphere, multilayer substrate was acquired.

【0025】得られた多層基板の色調を目視あるいは双眼により観察した。また、多層配線基板における絶縁基板自体の絶縁抵抗、および50 $\mu\text{m}$ の間隔で形成された回路間の絶縁抵抗を直流100Vを印加し測定した。また、絶縁基板の組織を電子顕微鏡により観察し、着色剤の最大粒径と組織状態を観察した。結果は表1に示した。

[0025] Color of multilayer substrate which it acquires was observed with visual or both eyes. In addition, insulating resistance of insulating substrate itself in multilayer metallized substrate, and insulating resistance between circuit which was formed with interval of the 50  $\mu\text{m}$ , imparting it did direct current 100V and measured. In addition, structure of insulating substrate was observed with electron microscope, the maximum particle diameter and structure state of dye were observed. It showed result in Table 1.

【0026】

[0026]

【表1】

[Table 1]

試料 No.	着色剤 種類 (wt%)	混練 時間 (hr)	最大 粒子径 (μm)	粒子の 分散状態	絶縁基板 の色調	絶縁基板の 電気抵抗 (Ω)	回路間 電気抵抗 (Ω)
* 1	無添加	1	—	—	白色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
2	炭素 0.01	2	5	独立	黒灰色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
3	炭素 0.05	2	4	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
4	炭素 1.0	2	4	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
5	炭素 1.0	1	1.2	一部連鎖	黒色	5 × 10 <sup>13</sup>	2 × 10 <sup>13</sup>
6	炭素 2.0	2	5	独立	黒色	6 × 10 <sup>12</sup>	4 × 10 <sup>12</sup>
7	炭素 3.0	2	5	独立	黒色	3 × 10 <sup>12</sup>	6 × 10 <sup>11</sup>
8	炭素 4.0	3	5	独立	黒色	7 × 10 <sup>11</sup>	2 × 10 <sup>10</sup>
9	炭素 5.0	3	4	独立	黒色	2 × 10 <sup>10</sup>	5 × 10 <sup>9</sup>
* 10	炭素 6.0	3	5	独立	黒色	3 × 10 <sup>9</sup>	4 × 10 <sup>7</sup>
11	SiC 1.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
12	SiC 3.0	3	6	独立	黒色	8 × 10 <sup>12</sup>	7 × 10 <sup>12</sup>
13	SiC 3.0	1	2.0	一部連鎖	黒色	5 × 10 <sup>11</sup>	2 × 10 <sup>10</sup>
* 14	SiC 6.0	3	4	独立	黒色	5 × 10 <sup>9</sup>	8 × 10 <sup>8</sup>
15	B <sub>4</sub> C 1.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
16	B <sub>4</sub> C 2.0	3	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
17	TiC 0.5	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
18	TiC 1.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
19	TiC 1.0	1	1.2	一部連鎖	黒色	6 × 10 <sup>12</sup>	6 × 10 <sup>12</sup>
20	Si <sub>3</sub> N <sub>4</sub> 1.0	2	4	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
21	Si <sub>3</sub> N <sub>4</sub> 2.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
* 22	Si <sub>3</sub> N <sub>4</sub> 5.5	3	5	独立	黒色	3 × 10 <sup>8</sup>	5 × 10 <sup>8</sup>
23	BN 0.5	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
24	BN 1.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
25	TiN 0.1	2	4	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
26	TiN 1.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
27	TiN 1.0	1	1.4	一部連鎖	黒色	8 × 10 <sup>12</sup>	5 × 10 <sup>12</sup>
* 28	TiN 6.0	3	5	独立	黒色	7 × 10 <sup>9</sup>	6 × 10 <sup>8</sup>
29	TiB <sub>2</sub> 1.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
30	TiB <sub>2</sub> 3.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
31	炭素 1.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>
32	炭素 1.0	2	5	独立	黒色	> 10 <sup>14</sup>	> 10 <sup>14</sup>

\*印は本発明の範囲外の試料を示す。

【0027】表1によれば、着色剤を0.01～5重量%の割合で添加することにより、基板自体を黒色にすることができ、配線回路とのコントラストが明確になった。着色剤無添加の時は、基板自体が白くなる。また、着色剤添加量が5重量%を越えると、基板は黒色を呈するが、絶縁抵抗が多層基板に必要とされる10<sup>9</sup> Ωより低くなつた。

[0027] It was possible to designate substrate itself as black, according to the Table 1, by adding dye at ratio of 0.01 to 5 wt%, contrast of the metallization circuit became clear. At time of dye no addition, substrate itself becomes white. In addition, when dye addition quantity exceeds 5 wt%, substrate displays the black, but it became lower than 10<sup>9</sup> Ω where insulating resistance is needed for multilayer substrate.

【0028】無機質フィラーと有機樹脂との均一混練は、試料No. 1に示すように、この実施例の混練方法では1時間で十分に混練できたが、導電性の着色剤を加えた場合、試料No. 4と試料No. 5、試料No. 12と試料No. 13、試料No. 18と試料No. 19、試料No. 26と試料No. 27との対比から明らかなように、混練時間が通常の混練時間では、試料No. 5、13、19、27のように凝集粒子が一部連なつ

[0028] As for uniform kneading of inorganic filler and organic resin, As shown in sample No.1, With 1 hour kneading it could designate with kneading method of this Working Example as fully, but, colorant of electrical conductivity was added when, sample No.4 sample No.5, sample No.12 sample No.13, sample No.18 sample No.19, As been clear from contrast with sample No.26 and sample No.27, kneading time with

た組織が見られ、回路間の抵抗が低くなる傾向にあったが、混練時間を通常の時間よりも2倍～3倍に延長することにより、着色剤を微細な粒子として独立した組織として分散することができ、これにより、回路間の絶縁性を高めることができた。

【0029】また、着色フィラーとして、炭素の他に、炭化珪素、炭化硼素、炭化チタン、窒化珪素、窒化硼素、窒化チタン、硼化チタンを用いても同様に、無機質フィラーや有機樹脂の種類にかかわらず、基板を黒色に着色させることができ、さらに、試料No.31、32に示すように、無機質フィラーや有機樹脂の種類を代えても同様な着色効果が得られた。

### 【0030】

【発明の効果】以上詳述した通り、本発明の多層配線基板は、無機フィラーと有機樹脂との複合材料からなる絶縁基板の電気絶縁性を損ねることなく、重厚感溢れる黒色系に呈色しているために、表面に形成された銅、アルミニウムなどの低抵抗金属からなる配線回路とのコントラストが明確であるために、光学的手段による電子部品の実装やICの実装、ボンディングなどに好適であり、しかも、シミや色むらなどの外観不良による歩留りの低下を低減することもできる。

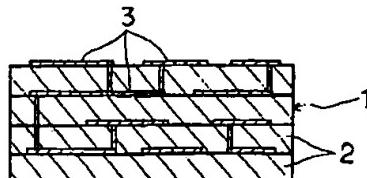
### 【図面の簡単な説明】

【図1】本発明の多層配線基板の概略図である。

### 【符号の説明】

- 1 多層配線基板
- 2 絶縁基板
- 3 配線回路

### 【図1】



conventional kneading time, sample No.5, Like 13 and 19, 27, as weave which becomes independent by extending in 2 times to 3 times it was in tendency where resistance between the circuit becomes low aggregated particle part weave which is connected to be seen, but, kneading time in comparison with conventional time, with colorant as microscopic particle it was possible, because of this, to disperse it was possible to raise insulating property between circuit.

[0029] In addition, as coloration filler, to other than carbon, in the same way, it was possible making use of silicon carbide, carbonizing boron, the titanium carbide, silicon nitride, boron nitride, titanium nitride and titanium boride to color the substrate to black regardless of types of inorganic filler and organic resin, as furthermore, shown in sample No.31 and 32, replacing types of inorganic filler and organic resin, similar coloring effect acquired.

### [0030]

[Effects of the Invention] Above you detailed sort, As for multi layer metallized substrate of this invention, Impair electrically insulating property of insulating substrate which consists of composite material of inorganic filler and organic resin it to be, weight feel because contrast of metallization circuit which consists of copper and aluminum or other low resistance metal which were formed to surface because coloration it has made black which overflows, is clear, it is ideal in mount of the electronic part with optical means and mount and bonding etc IC, furthermore, it is possible also to decrease decrease of yield rate with the blotch and color unevenness or other poor external appearance.

### [Brief Explanation of the Drawing(s)]

[Figure 1] It is a conceptual diagram of multilayer metallized substrate of this invention.

### [Explanation of Reference Signs in Drawings]

- 1 multilayer metallized substrate
- 2 insulating substrate
- 3 metallization circuit

### [Figure 1]

